LATE NOACHIAN ALLUVIAL AND LACUSTRINE DEPOSITIONAL SYSTEMS IN SOUTHWEST MARGARITIFER TERRA, MARS. J. A. Grant[1], R. P. Irwin, III[1], and S. A. Wilson[1], [1]Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, 6th St. at Independence Ave. SW, Washington, DC 20560, grantj@si.edu.

Introduction: Impact craters on Mars create deep enclosed drainages, and their raised rims often derange exterior drainage courses [1-5]. Noachian-aged craters [6] in southwestern Margaritifer Terra provide examples of both drainage patterns and preserve deposits associated with past alluvial and lacustrine activity.

Crater Basins: A number of large (>40 km across) craters punctuate SW Margaritifer Terra and typically display 1–2 km of relief along their walls. At ~150 km in diameter, Holden crater (26.0°S, 325.8°E) is the largest, with alluvial and likely lacustrine beds extending across its lower walls and floor [7]. Erosion of wall alcoves sourced the fans and lake [7] and transported phyllosilicate-bearing materials were mostly incorporated into lower strata [8]. Eberswalde crater (23.9°S, 326.6°E) is superposed by Holden ejecta and overlying fluvio-lacustrine sediments, including a delta on the western wall and lacustrine sediments on the crater floor [9, 10]. Ostrov crater (26.5°S, 332°E) is ~200 km east of Holden and is partially filled by alluvial fans that reach across the crater floor and embay the central uplift. Lake deposits appear largely absent, though beds near the basin center are consistent with a playa setting. An unnamed crater south of Ostrov (27.8°S, 332.8°E) also preserves broad alluvial fans fed from alcoves that are largest on the southwestern and northeastern walls. Despite a paucity of high-resolution coverage (by HiRISE), unnamed Noachian-aged [6] craters on the southwest (21.7°S, 320.6°E) and southeast (20.7°S, 324.3°E) rim of Vinogradov crater and ~150 km south (29.9°S, 326.4°E) and ~100 km southwest (27.3°S, 323.1°E) of Holden crater reveal evidence for comparable fans and/or lacustrine deposits.

Some craters show evidence for significant infilling by other processes (e.g., possibly volcanic or eolian) that may bury older alluvial or lacustrine deposits. Nevertheless, craters excavating fill in Chekalin crater (24.0°S, 333.2°E) reveal light-toned materials that may represent underlying water-lain deposits. Hence, late-Noachian alluvial and/or lacustrine deposits may be widespread in craters, but are ancient, often buried, or only rarely exposed by later erosion and imaged at high resolution (to date).

Uzboi Lake: Regional drainage is dominated by Uzboi Vallis (centered at ~28°S, 323°E), the southernmost segment of the northward-draining Uzboi-Ladon-Morava (ULM) meso-scale outflow system [3-5]. Formation of Holden crater blocked the ULM and created a large (>4000 km^3) geologically short-lived lake in Uzboi during the late Noachian [5], before the crater rim was overtopped and water drained into Holden [7]. Tributaries to the Uzboi lake [5] incised a regional phyllosilicate-bearing layer [11], whose sediments were transported and deposited in the basin.

Discussion: The preservation of alluvial and likely lacustrine sequences in craters and a lake basin in Uzboi Vallis in southwest Margaritifer Terra implies widespread water-related degradation during a geologically brief period in the late Noachian [5, 12, 13]. Craters preserving these aqueous deposits are at varying elevations, and there was little to no standing water in some (e.g., Ostrov). Source alcoves eroded well into the rim of some craters and, coupled with evidence for regional runoff into the Uzboi lake [6], suggest that synoptic precipitation was the dominant water source.

The morphometry and sedimentology of these alluvial and lacustrine deposits record the hydrologic and climatic conditions present during their emplacement. The short duration of wet conditions responsible for the formation of the deposits suggests most incorporated phyllosilicates are allocthanous and are derived from older deposits [14] and/or are related to impact alteration. Nevertheless, their preservation and (in some instances) relative accessibility suggests that they are high-priority targets for future exploration aimed at understanding the past habitability of Mars.

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